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JCS35 U.S. PTO

UTILITY PATENT APPLICATION TRANSMITTAL

Only for new nonprovisional applications under 37 CFR 1.53(b)

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

Attorney Docket No. 862.C1936

First Named Inventor or Application Identifier

TOSHIKI SAITO

Express Mail Label No.

Assistant Commissioner for Patents
Box Patent Application
Washington, DC 20231

ADDRESS TO:

1. ☐ Fee Transmittal Form
(Submit an original, and a duplicate for fee processing)

2. ☒ Specification Total Pages 52

3. ☒ Drawing(s) (35 USC 113) Total Sheets 15

4. ☒ Oath or Declaration Total Pages 2

- a. ☒ Newly executed (original or copy)
b. ☐ Unexecuted for information purposes
c. ☐ Copy from a prior application (37 CFR 1.63(d))
(for continuation/divisional with Box 17 completed)
[Note Box 5 below]

- i. ☐ **DELETION OF INVENTOR(S)**
Signed Statement attached deleting inventor(s)
named in the prior application, see 37 CFR
1.63(d)(2) and 1.33(b).

5. ☐ Incorporation By Reference (useable if Box 4c is checked)
The entire disclosure of the prior application, from which a copy of the
oath or declaration is supplied under Box 4c, is considered as being
part of the disclosure of the accompanying application and is hereby
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6. ☐ Microfiche Computer Program (Appendix)

7. Nucleotide and/or Amino Acid Sequence Submission
(if applicable, all necessary)

- a. ☐ Computer Readable Copy
b. ☐ Paper Copy (identical to computer copy)
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ACCOMPANYING APPLICATION PARTS

8. ☒ Assignment Papers (cover sheet & document(s))
9. ☐ 37 CFR 3.73(b) Statement ☐ Power of Attorney
(when there is an assignee)
10. ☐ English Translation Document (if applicable)
11. ☐ Information Disclosure Statement (IDS)/PTO-1449 ☐ Copies of IDS Citations
12. ☐ Preliminary Amendment
13. ☒ Return Receipt Postcard (MPEP 503)
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14. ☐ Small Entity ☐ Statement filed in prior application
Statement(s) Status still proper and desired
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17. If a CONTINUING APPLICATION, check appropriate box and supply the requisite information:

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CLAIMS	(1) FOR	(2) NUMBER FILED	(3) NUMBER EXTRA	(4) RATE	(5) CALCULATIONS
TOTAL CLAIMS (37 CFR 1.16(c))		23-20 =	3	X \$ 18.00 =	\$ 54.00
INDEPENDENT CLAIMS (37 CFR 1.16(b))		15-3 =	12	X \$ 78.00 =	\$936.00
MULTIPLE DEPENDENT CLAIMS (if applicable) (37 CFR 1.16(d))				\$260.00 =	\$ 0.00
				BASIC FEE (37 CFR 1.16(a))	\$690.00
				Total of above Calculations =	\$1,680.00
				Reduction by 50% for filing by small entity (Note 37 CFR 1.9, 1.27, 1.28).	
				TOTAL =	\$1,680.00

19. Small entity status

- a. ☐ A Small entity statement is enclosed
- b. ☐ A small entity statement was filed in the prior nonprovisional application and such status is still proper and desired.
- c. ☐ Is no longer claimed.

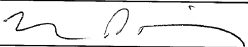
20. ☒ A check in the amount of \$ 1,608.00 to cover the filing fee is enclosed.

21. ☒ A check in the amount of \$ 40.00 to cover the recordal fee is enclosed.

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- a. ☒ Fees required under 37 CFR 1.16.
- b. ☒ Fees required under 37 CFR 1.17.
- c. ☐ Fees required under 37 CFR 1.18.

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

NAME	Leonard P. Diana (Reg. No. 29,296)
SIGNATURE	
DATE	June 28, 2000

TITLE OF THE INVENTION
IMAGE COMMUNICATION METHOD AND APPARATUS

FIELD OF THE INVENTION

5 The present invention relates to an image communication method and apparatus for transmitting/receiving image signals.

BACKGROUND OF THE INVENTION

10 With the recent progress in the functions of image recording means and image display means, high-quality color copying machines, color printers, and the like have become rapidly popular. In the field of image communication apparatuses, color facsimile
15 apparatuses and the like have been developed. Communication schemes for such color facsimile apparatuses are being standardized as ITU-T recommendations such as T30, T40, T42, and T81. In addition, as an encoding scheme for such color images,
20 T81 of JPEG (Joint Photographic Expert Group) is used.

 In a color facsimile apparatus standardized as the ITU-T recommendation T30, as minimum requirements for color image data, a width in the main scanning direction: A4 and a resolution: 200 dpi are defined.
25 As options, a width in the main scanning direction: B4/A3 and a resolution: 100/300/400 dpi can be selected.

As color printing schemes, a thermal sublimation transfer scheme, thermal fusion transfer scheme, electrophotographic scheme, ink-jet scheme, and the like are known. The respective schemes have merits and
5 demerits in terms of color image reproducing capability. In addition, the color reproducing capability varies depending on the type of printing paper to be used, the type of ink, and the arrangement of an apparatus.

There are growing user needs for transmission of
10 an image having a size equivalent to, for example, a snapshot by using such a color facsimile apparatus. With a conventional facsimile apparatus, however, even when an image of such a size is transmitted, since the minimum size of an image that can be
15 transmitted/received is A4, the image is transmitted as an A4-size document. For this reason, the receiving apparatus prints even the image of the snapshot size on an A4-size printing sheet, resulting in a waste of the printing sheet. In addition, an expensive, special
20 printing sheet is used to print a sharp color image. In this case, an expensive printing sheet is wasted.

Furthermore, when a small-size image like the one described above is transmitted in A4 size, even a meaningless data portion is produced as image data. As
25 a consequence, useless transmission data increases in

amount, and the communication time is prolonged accordingly, resulting in an extra communication cost.

In the color facsimile procedure according to the T30 recommendation, a quantization table that
5 determines image quality in compressing (JPEG-compressing) a color image is also sent to the receiving apparatus. This means that the reproduction quality of image data to be transmitted can be arbitrarily determined on the transmitting side. For
10 this reason, for example, even if the color reproducing capability of the apparatus on the receiving side is low, the quality of an image generated on the transmitting side may become excessively high. In such a case, the amount of unnecessary transmission data
15 increases, and hence the corresponding communication time and cost are wasted.

SUMMARY OF THE INVENTION

The present invention has been made in
20 consideration of the prior art described above, and has as its object to provide an image communication method and apparatus in which when image data is compressed on the transmitting side, the valid image area of the compressed data is set and the receiving side is
25 notified of it, thereby allowing the receiving side to

extract only the valid image area and print it on a printing medium of a size suitable for it.

It is another object of the present invention to provide an image communication method and apparatus
5 which can prevent image data transmitted from the transmitting side from being wasted by transmitting image data to the receiving side in accordance with the printing capability of the receiving side.

It is still another object of the present
10 invention to an image communication method and apparatus which can save communication time by decreasing the amount of transmission data by compressing image data, when the size of an original image to be transmitted is smaller than the size
15 defined in a communication procedure according to the recommendation, after adding invalid data to the image data of the original image to make it have a size equal to the defined size.

It is still another object of the present
20 invention to provide an image communication method and apparatus which can transmit an original image of an arbitrary size, when the size of the original image on the transmitting side is the size defined in the communication procedure according to the recommendation,
25 by declaring that image data of a size smaller than the defined size can be received.

It is still another object of the present invention to provide an image communication method and apparatus for transmitting image data from the transmitting side to the receiving side in accordance with a receiving/printing capability of receiving and printing image data on the receiving side.

In order to achieve the above objects, according to the present invention, there is provided an image communication apparatus for communicating a color image with a distant apparatus according to the ITU-T recommendations upon establishing line connection, comprising original read means for generating image data by reading an original image, identification means for identifying a size of the original image read by the original read means, compression means for compressing the image data, and control means for, when the size of the original image, identified by said identification means, is smaller than a page size defined by the recommendation, causing said original read means to read the original image upon adding invalid data thereto to make the image data have a page size equal to the page size defined by the recommendation, and performing control to set a valid image area of the image data compressed in accordance with the size of the original image in a case where the

image data is compressed by the compression means and transmitted.

In addition, according to the present invention, there is provided an image communication apparatus for
5 communicating a color image with a distant apparatus according to the ITU-T recommendations upon establishing line connection, comprising original read means for generating image data by reading an original image, identification means for identifying a size of
10 the original image read by the original read means, compression means for compressing the image data, and control means for, when the size of the original image, identified by the identification means, is smaller than a page size defined by the recommendation, causing the
15 original read means to read the original image in the size of the original image and performing control to designate a size of the original image in a case where the image data is compressed by the compression means and transmitted.

20 Other features and advantages of the present invention will be apparent from the following description taken in conjunction with the accompanying drawings, in which like reference characters designate the same or similar parts throughout the figures
25 thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate embodiments of the invention and, together with the description, serve to explain the principles of the invention.

Fig. 1 is a block diagram showing the arrangement of a color facsimile apparatus according to an embodiment of the present invention;

10 Fig. 2 is a perspective view of the color facsimile apparatus according to this embodiment;

Fig. 3 is a plan view of the operation panel of the color facsimile apparatus of this embodiment;

15 Fig. 4 is a block diagram showing the flow of data in image transmission in the color facsimile apparatus of this embodiment;

Fig. 5 is a block diagram showing the flow of data in image reception in the color facsimile apparatus of this embodiment;

20 Fig. 6 is a view for explaining an example of a color communication procedure in the color facsimile apparatus of this embodiment;

Fig. 7 is a view for explaining the data structure of JPEG baseline encoded data in this
25 embodiment;

Fig. 8 is a view for explaining COM marker parameters in this embodiment;

Fig. 9 is a flow chart showing transmission (calling party) processing in the color facsimile apparatus of this embodiment;

Fig. 10 is a flow chart showing color image transmission processing in step S909 in Fig. 9;

Fig. 11 is a flow chart showing image reception (receiving side) processing in the color facsimile apparatus of this embodiment;

Fig. 12 is a flow chart showing DIS signal generation processing in step S1101 in Fig. 11;

Fig. 13 is a flow chart showing image data reception processing in step S1105 in Fig. 11;

Fig. 14 is a flow chart showing printing processing for a received page in the color facsimile apparatus of this embodiment; and

Fig. 15 is a view for explaining a received page management information table according to this embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Characteristic features of an embodiment of the present invention will be described below first.

In reading an original image and transmitting the resultant data, an image communication apparatus (e.g.,

therefore be applied to other general color facsimile apparatuses without posing any problem.

If the original size is small in reading an original image, blank data is added as invalid data to the original image to make it have a main scanning length equal to the minimum main scanning length of a page defined by the recommendation T30. With this operation, the image data to be JPEG-compressed is data obtained by adding minimum necessary data to valid image data, and hence an increase in the amount of compressed data can be minimized, thereby saving the communication time.

In addition, when the main scanning size (A4/A4, B4/A4, B4, or A3) defined by the recommendation T30 is declared as the main scanning size of image data that can be received and is declared on the receiving side, information declaring that any image data having a main scanning size equal to or smaller than the declared as a maximum value can be received is defined in a DIS signal according to the ITU-T recommendation T30. With this operation, since image data having an arbitrary size within the maximum original size declared on the receiving side can be transmitted, no invalid image data is transmitted.

Furthermore, color reproducing capability information for notifying the transmitting side of the

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color image reproducing capability of the receiving apparatus when a color image is output in image printing or display operation on the receiving side is defined in a DIS signal according to the ITU-T

5 recommendation T30. This allow the transmitting side to select an optimal compression parameter for determining the image quality of transmission data in accordance with the capability of the receiving side, thereby eliminating waste, i.e., transmitting
10 high-quality image data to even a receiving apparatus having a low color reproducing capability.

A preferred embodiment of the present invention will be described in detail below with reference to the accompanying drawings. An image communication
15 apparatus of this embodiment is a facsimile apparatus which has a G3 facsimile communication function and is connected to an analog telephone line when it is used. A color image transmission/reception function is added to this apparatus.

20 Fig. 1 is a block diagram showing the arrangement of a color facsimile apparatus according to an embodiment of the present invention.

Referring to Fig. 1, a CPU 101 controls this apparatus as a whole. The CPU 101 uses a ROM 102 as a
25 program memory to perform various control operations. A RAM 103 is used as a work area or the like of the CPU

101. The RAM 103 is backed up by a battery so that the stored contents are not erased when the apparatus is powered off.

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A coding/decoding (CODEC) unit 104 has a
5 raster-block conversion unit, color converter, and JPEG encoding unit as units constituting a transmission system, and a block-raster conversion unit, color converter, and JPEG decoding unit as units constituting a reception system. In encoding operation, upon
10 reception of color component signals of R, G, and B (red (R), green (G), and blue (B) as multivalued signals each consisting of eight bits per pixel, the CODEC unit 104 can output JPEG baseline encoded data after converting the signals into L*, a*, and b* signal
15 components. In decoding operation, upon reception of JPEG baseline encoded data, the CODEC unit 104 obtains L*, a*, and b* multivalued data each consisting of eight bits by decoding the input data, and then outputs the data upon conversion from the L*a*b* color space to
20 the CMYK color space. That is, the CODEC unit 104 includes a JPEG encoder/decoder and color conversion circuits.

A modem 105 complies with the ITU-T recommendations V8/V34/V17/V29/V27ter, and
25 modulates/demodulates transmission/reception signals. An NCU (Network Control Unit) 106 performs, for example,

connection control with a telephone network 115. A timer circuit 107 includes, for example, a clock LSI having a calendar function, and measures a predetermined time, current date and time, and the like in accordance with instructions from the CPU 101. An operation panel 108 includes various operation keys and a display unit. An image memory 109 is formed by a semiconductor memory and controlled to store image data in units of pages. A color scanner 110 optically reads an original, separates the read data into R, G, and B components, and outputs each color pixel as 8-bit multivalued data. The color scanner 110 in this embodiment uses a color contact sensor as a read device, and has an ADF mechanism for automatically feeding an original to be read.

A printer interface (I/F) unit 111 has a binary processing unit and an interface control unit, and performs connection control with a printer unit 112 through a general-purpose interface 113 according to the Centronics specifications. Upon reception of multivalued signals of C, M, Y and K colors, the printer interface unit 111 converts each color data into binary data, and controls the general-purpose interface to transmit the data to the printer unit 112. The printer interface unit 111 also has the function of

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detecting the status of the printer unit 112 through the interface and notifying the CPU 101 of the status.

The printer unit 112 is capable of color printing and monochromatic printing by the ink-jet printing scheme. As ink cartridges that can be loaded into the printer unit 112, ink cartridges for monochromatic printing/color printing/high-resolution color printing and the like are available. The type of cartridge loaded can be recognized by the printer interface unit 111. Note that these units described above are connected through a CPU bus 114.

Assume that in this embodiment, the control programs shown in the flow charts of Figs. 9 to 14 (to be described later) are stored in the ROM 102. However, these control programs may be supplied to this apparatus while being stored in a storage medium such as a floppy disk or CD-ROM, downloaded into the RAM 103, and executed by the CPU 101.

Fig. 2 is a perspective view of the color facsimile apparatus of this embodiment. Fig. 3 is a plan view showing the outer appearance of the operation panel 108 of this color facsimile apparatus.

Referring to Fig. 2, an original table 201 on which an original is to be set is mounted on the upper surface of the casing of the apparatus. Slidable original guides are attached to the two sides of the

original table 201 to prevent a ramp of an original when it is conveyed. In this embodiment, the size of an original placed on the original table 201 can be recognized by a sensor (not shown) for detecting the distance between (positions of) the original guides. The operation panel 108 is mounted on the upper surface of the original table 201, and an original discharge tray 203 onto which a read original is discharged is disposed behind the operation panel 108. A printing paper discharge unit 204 onto which a printed printing sheet is discharged is disposed on the front surface of the casing of the apparatus. First and second printing paper cassettes 205 and 206 in which printing sheets are set, are mounted on the lower surface of the casing of the apparatus. For example, A4-size sheets can be set in the first cassette 205, and postcard-size sheets can be set in the second cassette 206. This apparatus has a mechanism for recognizing the size and type of printing paper stored in each cassette. In this embodiment, the user operates the operation panel 108 to set the size of printing paper and the type of printing paper (plain paper/special color printing paper) stored in each cassette, thereby allowing the apparatus to recognize them. However, the present invention is not limited to this. For example, the

apparatus may automatically recognize them by using a printing paper sensor or the like that can detect them.

Referring to Fig. 3, a ten-key pad 301 is made up of 12 types of keys, i.e., numeral keys "0" to "9" and function keys "#" and "*", and mainly used as a telephone number input means. An LCD display unit 302 performs display operation to display the status of the apparatus or check an input telephone number. A one-touch key 303 is used to perform one-touch transmission by reading out a destination number or the like written in the RAM 103 in advance. A start key 304 gives an instruction to start, for example, transmission or copying operation. A stop key 305 is used to stop operation during execution. A color key 306 is a key for designating a mode for processing an original as a color original. When the mode for processing an original as a color original is designated, a lamp 307 is turned on. When the key 306 is pressed while the lamp 307 is on, the lamp 307 is turned off and a mode in which an original is not processed as a color original is set. In this manner, every time the key 306 is pressed, the modes are alternately switched. A color indicator lamp 308 is kept on while a state in which color printing can be performed by the printer unit 112 is detected. A resolution selection key 309 is a key used to switch

read resolutions in reading an original. Every time the key 309 is pressed, the resolutions are switched. By using the resolution selection key 309, the user can adjust the coarseness (resolution) of an image to be transmitted.

Fig. 4 is a block diagram for explaining the flow of transmission image data in the color facsimile apparatus according to this embodiment. Fig. 5 is a block diagram for explaining the flow of reception image data in this apparatus.

In image data transmission shown in Fig. 4, an original 407 is irradiated with a white light source 408, and the reflected light from the original 407 is read by the scanner 110 including a color contact sensor 409. The scanner then converts each analog signal, separated into R, G, and B primary colors, into 8-bit digital data for each of R, G, and B, and outputs it to the CPU bus 114 (Fig. 1).

When this original is a color original, the read color image data is input to the CODEC unit 104 via the CPU bus 114. The CODEC unit 104 temporarily stores the image data in a buffer memory (not shown). In this case, if the original size is smaller than the page size defined by the ITU-T recommendation, blank data is added as invalid data to a portion which exceeds the original size so as to make the original data coincide

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with the defined minimum page size (404). This image data is then raster-block-converted by raster-block conversion 401. In this raster-block conversion 401, the respective 8-bit data transferred and stored as

5 raster signals in the order of R, G, and B are rearranged into an 8 (pixels) x 8 (pixels) block matrix, thereby generating block-sequential data arranged like R block, G block, B block, R block,....

In this scanner 110, the back of the original 407

10 is supported by a white plate. If, therefore, the size of the original 407 is smaller than the standard size (the page size defined by the ITU-T recommendation), invalid data (blank data) based on light reflected by the white plate is automatically input in a portion

15 outside the original 407.

Such block-sequential RGB data are subjected to known color space transformation operation in color space transformation 402 to obtain block-sequential $L^*a^*b^*$ data from the RGB data. In JPEG compression 403,

20 this data sequence is JPEG-encoded. The JPEG-encoded image data is then output from the CODEC unit 104 to the image memory 109. The JPEG-encoded data is transferred to the modem 105 via the image memory 109, and transmitted from the NCU 106 to the telephone

25 network 115.

Fig. 6 is a view for explaining an example of a communication procedure in the color facsimile apparatus according to this embodiment, and shows the basic flow of processing complying with the ITU-T recommendation T30.

In phase B, the called party (receiving side) declares "color image receiving capability" as a capability of the self-terminal by using a DIS signal. With this operation, the calling party (transmitting side) confirms "color receiving capability" of the called party (receiving side), and designates "color image transmission" by a DCS signal. In phase C, the transmitting side transmits the JPEG baseline encoded/compressed color image data in units of ECM blocks.

Fig. 7 is a view for explaining an example of the data structure of JPEG baseline encoded data in color image communication defined by the ITU-T recommendations T4 and T81.

One-page data is made of the image frame data set between SOI and EOI markers. This image frame is separated into a so-called JPEG header portion including, for example, APP1, DQT, DHT, COM, and SOF0 markers following the SOI marker, and a JPEG compressed data portion starting with an SOS marker.

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In the color image communication procedure defined by the ITU-T recommendations T30 and T4, the usage of the APPl marker is defined as G3FAX. The DQT marker defines a quantization table in JPEG compression.

- 5 With this quantization table, the image compression ratio and image quality are changed. The DHT marker defines a Huffman table. The COM maker is a marker written in a comment, and is defined by the ITU-T recommendation T4 as a marker that can be neglected in
- 10 decoding. The SOF marker defines various parameters in baseline DCT compression. These parameters include the main scanning pixel count and sub-scanning pixel count of image data.

- If the sub-scanning pixel count is indefinite in
- 15 JPEG-compressing image data owing to the arrangement of the facsimile apparatus, "0" is set as the sub-scanning pixel count on the SOF0 marker, and the sub-scanning pixel count of the compressed image data can be set again by a DNL marker after the compressed data
- 20 starting with the SOS marker.

Fig. 8 is a view for explaining an example of how the COM marker is used to designate a valid image area in the facsimile apparatus according to this embodiment.

- According to the ITU-T recommendations T30 and T4,
- 25 the size of one page in the main scanning direction in color image communication is defined as A4/B4/A3. For

example, the main scanning length of image data that is
JPEG-compressed in A4 and 200 dpi is defined as 1,728
pixels. If an original to be actually transmitted is
shorter than the width of an A4-size sheet, the
5 transmitting side can notify the receiving side of a
valid image size in compliance with the ITU-T
recommendation by designating a valid image area using
this COM marker.

Referring to Fig. 8, for the transmission image
10 data area (1,728 pixels (horizontal) x 700 pixels
(vertical)) designated by SOF0, the COM marker is used
to designate upper, lower, left, and right invalid
portions (marginal portions: TOP (upper side): 10, LEFT,
RIGHT (left and right sides): 300, and BOTTOM (lower
15 side): 20 in the case shown in Fig. 8) of the
transmission image data area designated by the SOF0
marker, thereby making the receiving side recognize a
valid image area of the transmission image data area.

Fig. 9 is a flow chart showing processing to be
20 performed when the color facsimile apparatus according
to this embodiment serves as a transmitting side
(calling party). Note that a program for executing
this processing is stored in the ROM 102.

In step S901, the transmitting apparatus
25 originates a call to the destination by using a dialing
number stored in the RAM 103 or operating the ten-key

pad 301, thereby establishing line connection. In step
S902, the transmitting apparatus transmits CNG. If DIS
is received in step S903, the flow advances to step
S904 to determine the color receiving capability of the
5 receiving apparatus as the called party. If the
receiving apparatus has no color receiving capability,
the flow advances to step S915 to transmit DCN and
perform error termination.

If the receiving apparatus has a color receiving
10 capability, the flow advances from step S904 to step
S905 to check whether the receiving apparatus as the
called party according to this embodiment has the
capability of receiving color image of an indefinite
size. In this step, it is checked whether the
15 receiving apparatus has declared, with the DIS signal,
information indicating that it can receive any color
image of a main scanning length (indefinite size)
smaller than the standard size declared by DIS as a
maximum value. If the receiving apparatus has the
20 capability of receiving a color image of an indefinite
size, the flow advances to step S906 to turn on an
indefinite size transmission enable flag (set in the
RAM 103) indicating that transmission can be performed
in an indefinite size to the receiving apparatus. With
25 this operation, in transmitting an original of a size
smaller than a standard size to the receiving apparatus,

the transmitting apparatus can transmit a color image without adding useless, invalid data to it in a transmission phase of the color image data, thus shortening the communication time.

5 Assume that it is determined in step S905 that
the receiving apparatus does not have the capability of
receiving a color image of an indefinite size, or the
flow advances from step S906 to step S907 in which
information designating color image transmission is
10 received, and the indefinite size transmission enable
flag described above is turned on to transmit the
indefinite-size image. In this case, the transmitting
apparatus transmits DCS having information designating
indefinite-size image transmission to the receiving
15 apparatus, and then transmits TCF. Thereafter, the
flow advances to step S908. If CFR is received from
the receiving apparatus, the flow advances to step S909
to perform transmission processing for a 1-page color
image (refer to Fig. 6 for these procedures). The
20 processing in step S909 will be described in detail
later with reference to the flow chart of Fig. 10.

Subsequently, the flow advances to step S910 to check whether there is transmission data of the next page. If the image data of the next page is present, 25 the flow advances to step S911 to transmit PPS-MPS. The flow advances to step S912 to wait for the

reception of MCF. The flow then returns to the processing in step S909.

If it is determined in step S910 that there no transmission data of the next page, the flow advances to step S913 to transmit PPS-EOP. The flow advances to step S914 to wait for the reception of MCF. The flow then advances to step S915 to transmit DCN, thereby terminating the processing.

Fig. 10 is a flow chart showing color image transmission processing in step S909 described above.

In step S1001, it is checked whether the size of a transmission original is a standard size such as A4 size that is commonly handled in facsimile apparatuses. In this embodiment, several different original widths are detected by an original width sensor (not shown) for detecting the set positions of the original guides described above. If the size of the original is a standard size (e.g., A4), the flow advances to step S1007 to instruct the color scanner 110 to read the original in the standard original width. In step S1008, the SOF0 marker of a JPEG header is set to the standard size (A4).

If it is determined in step S1001 that the size of the transmission original is indefinite, the flow advances to step S1002 to check, on the basis of the indefinite size transmission enable flag set in the RAM

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103 in step S906, whether the receiving apparatus is capable of receiving color image data of an indefinite size. If the receiving apparatus can receive data of an indefinite size, the flow advances to step S1003 to
5 instruct the color scanner 110 to read the original image in the original width obtained by the original width detector. In step S1004, the SOF0 marker of the JPEG header is set to the read original width.

If it is determined in step S1002 that the
10 receiving apparatus cannot receive data in an indefinite size, the flow advances to step S1005 to execute read control such that blank data is added to the image data read in the original width obtained by the original width detector so as to increase the
15 original size to a standard size. In step S1006, the standard size is set as the SOF0 marker of the JPEG header, and information indicating a valid image area is set in the COM marker.

After one of steps S1004, S1006, and S1008 is
20 executed in this manner, the flow advances to step S1009 to recognize the color reproducing capability information of the receiving apparatus from the information of the received DIS signal. In this case, information consisting of several bits is assigned for
25 the declaration of this color reproducing capability so as to express a color reproduction capability in

the transmission of 1-page image data is complete, this processing is terminated.

Figs. 11, 12, and 13 are flow charts showing processing to be performed when the color facsimile apparatus of this embodiment receives image data. A control program for executing this processing is stored in the ROM 102.

Fig. 11 shows a flow chart showing reception processing in the color facsimile apparatus of this embodiment.

When a response to an incoming call is sent in step S1100, the flow advances to step S1101 to execute DIS signal generation processing (to be described later with reference to the flow chart of Fig. 12). In step S1102, a DIS signal is transmitted. The flow then advances to step S1103 to wait for reception of a DCS signal from the transmitting facsimile apparatus (calling party). If an image signal can be received, a CFR signal is transmitted (step S1104). With this operation, the transmitting apparatus starts transmitting image data, and the image data is received (this operation will be described later with reference to the flow chart of Fig. 13). The received image data is stored in the image memory 109 (step S1105).

If it is determined in step S1106 that a Q signal is received from the transmitting side, the flow

advances to step S1107 to transmit an MCF signal indicating acknowledgement of reception. In step S1108, it is checked on the basis of the Q signal whether there is image data of the next page. If YES in step 5 S1108, the above processing is repeated from step S1105 or step S1102. If NO in step S1108, the flow advances to step S1109 to wait for reception of a DCN signal sent from the transmitting side. The communication processing is then terminated.

10 Fig. 12 is a flow chart showing the DIS signal generation processing in step S1101 in Fig. 11.

In step S1201, it is checked whether the receiving apparatus has a color receiving capability. In this embodiment, this step is performed by checking 15 whether a color ink cartridge is loaded into the printer unit 112. If NO in step S1201, the flow skips to step S1208 to set a parameter for the declaration of a receiving capability other than the color receiving capability in a DIS signal.

20 If YES in step S1201, the flow advances to step S1202 to set a parameter indicating a color receiving capability in the DIS signal. The flow then advances to step S1203 to set a bit for declaring the capability of receiving a JPEG file of a main scanning pixel count 25 smaller than that of a standard size such as A4 defined in the DIS signal. This capability is a characteristic

feature of this embodiment. The flow advances to step S1204 to determine a color reproducing capability in color printing depending on whether a high-resolution color ink cartridge or general color ink cartridge is mounted into the printer unit 112 and whether plain paper or special color printing paper is set in the paper cassettes 205 or 206. In this case, color reproducing capabilities are classified into a high-quality capability, intermediate-quality capability, and low-quality capability according to these conditions. On the basis of the classification result, the capability determined in step S1204 is set in the bit for declaring the color reproducing capability information defined in the DIS signal in one of steps S1205, S1206, and S1207. The flow then advances to step S1208 to set a parameter for the declaration of a receiving capability other than the color receiving capability in the DIS signal, thus terminating this DIS signal generation processing.

Assume that when a high-resolution color ink cartridge is mounted, and special color printing paper is stored in the paper cassette (205 or 206), the high-quality color reproducing capability is determined. Similarly, when only one of the conditions that a high-resolution color ink cartridge is mounted and special color printing paper is stored in the paper

scanning pixel count (PAGE_H_SIZE). In addition, both an upper end (TOP) and left end (LEFT) as valid data start positions are set to "0". A valid data main scanning pixel count (VALID_H_SIZE) is set to the same value as that of the page data main scanning pixel count (PAGE_H_SIZE). A page data sub-scanning pixel count (PAGE_V_SIZE) and valid data sub-scanning pixel count (VALID_V_SIZE) are set when reception of image data is complete.

- 10 When a color image is to be received, the flow advances to step S1302 to set a page data type, page resolution, page data main scanning pixel count, and the like in the page management information table (see Fig. 15) for managing stored image data.
- 15 More specifically, JPEG encoding is set as a page data type (DATA_TYPE), and the resolution obtained by analyzing DCS is set as a page resolution (RESOLUTION). The JPEG header of a JPEG file to be received is analyzed, and the image sizes (main scanning pixel
- 20 count and sub-scanning pixel count) of received image data which is designated by an SOF0 marker are set as a page data main-scanning pixel count (PAGE_H_SIZE) and a page data sub-scanning pixel count (PAGE_V_SIZE) (step S1302). If it is determined in step S1303 that the
- 25 JPEG header includes a COM marker, it is checked whether the valid image area of the JPEG compressed

data portion which is designated by the COM marker is set. If a valid image area is designated, the flow advances to step S1304 to set a valid data start position (upper end (TOP)/left end (LEFT)) and valid data main scanning and sub-scanning pixel counts (VALID_H_SIZE and VALID_V_SIZE) in the page management information table in accordance with the valid image area information designated by the COM marker.

If it is determined in step S1303 that the valid image area of the JPEG-compressed data portion is not set by the COM marker, the flow advances to step S1305 to set both the valid data start positions (upper end/left end) in the page management information table to "0" and also set valid data main and sub-scanning pixel counts to the same values as those of the page data main and sub-scanning pixel counts. When one of steps S1304, S1305, and S1306 is executed, the flow advances to step S1307 to store received image data in the image memory associated with the page management information table.

Fig. 14 is a flow chart showing operation to be performed when image data received in units of pages in the above manner is output to the printer unit 112 to be printed.

25 In step S1401, it is checked whether there is a
page management information table to be received and

printed. If there is a received page to be printed, the flow advances to step S1402 to recognize the size of a valid image which is obtained from the page resolution and valid data main and sub-scanning pixel counts in the page management information table. The flow then advances to step S1403 to check whether a printing sheet having a size suitable for printing of the image data is set in the paper cassette (205 or 206) of the printer unit 112. If NO in step S1403, the flow advances to step S1405 to display information on the LCD 302 of the operation panel 108 or the like to prompt the user to set a printing sheet having a corresponding size. The flow then returns to step S1403. If a proper printing sheet is set, the flow advances to step S1404 to control feeding of the printing sheet from the paper cassette. In step S1406, the received image data in the image memory 109 associated with the page management information table is decoded, and its valid image area is extracted, thus executing a printing process.

In the above description of this embodiment, the following are defined in the DIS signal according to the ITU-T recommendation T30:

(1) information declaring that any image data
25 having a main scanning size equal to or smaller than
the main scanning size (A4/A4 or B4/A4, B4, or A3)

defined by the recommendation T30 as a maximum value when it is declared; and

- (2) color reproducing capability information for notifying the transmitting side of the color image
- 5 reproducing capability of the receiving side when a color image is output in printing or display operation on the receiving side.

The two methods of additionally defining information have been described above. However, these

10 pieces of information as an NSF signal can also be defined as information in a nonstandard procedure.

Note that the present invention may be applied to either a system constituted by a plurality of devices (e.g., a host computer, an interface device, a reader, a

15 printer, and the like), or an apparatus consisting of a single device (e.g., a copying machine, a facsimile apparatus, or the like).

The objects of the present invention are also achieved by supplying a storage medium, which records a

20 program code of a software program that can realize the functions of the above-mentioned embodiments to the system or apparatus, and reading out and executing the program code stored in the storage medium by a computer (or a CPU or MPU) of the system or apparatus. In this

25 case, the program code itself read out from the storage medium realizes the functions of the above-mentioned

necessary data to valid image data, thereby saving the communication time.

In addition, according to this embodiment, when the main scanning size (A4/A4, B4/A4, B4, or A3) defined by the recommendation T30 is declared as the main scanning size of image data that can be received and is declared on the receiving side, information declaring that any image data having a main scanning size equal to or smaller than the declared as a maximum value can be received is defined in a DIS signal according to the ITU-T recommendation T30. With this operation, since image data having an arbitrary size within the maximum original size declared on the receiving side can be transmitted, no invalid image data is transmitted.

In addition, color reproducing capability information for notifying the transmitting side of the color image reproducing capability of the receiving side when a color image is output in printing or display operation on the receiving side is defined in a DIS signal according to the ITU-T recommendation T30, thereby allowing the transmitting side to select an optimal compression parameter that defines the quality of image data to be transmitted. This makes it possible to eliminate waste, i.e., transmitting high-quality image data to even a receiving apparatus having a low color reproducing capability.

The present invention is not limited to the above
embodiments and various changes and modifications can
be made within the spirit and scope of the present
invention. Therefore, to apprise the public of the
5 scope of the present invention, the following claims
are made.

WHAT IS CLAIMED IS:

1. An image communication apparatus for communicating a color image with a distant apparatus according to the ITU-T recommendations upon
5 establishing line connection, comprising:
 original read means for generating image data by reading an original image;
 identification means for identifying a size of the original image read by said original read means;
10 compression means for compressing the image data;
 and
 control means for, when the size of the original image, identified by said identification means, is smaller than a page size defined by the recommendation,
15 causing said original read means to read the original image upon adding invalid data thereto to make the image data have a page size equal to the page size defined by the recommendation, and performing control
20 to set a valid image area of the image data compressed in accordance with the size of the original image in a case where the image data is compressed by said compression means and transmitted.
2. The apparatus according to claim 1, wherein the
25 invalid data is blank data.

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3. The apparatus according to claim 1, wherein the
invalid data is added while said read means reads the
original image in a main scanning width of the page
size defined by the recommendation with a white plate
5 placed behind the original image.

4. The apparatus according to claim 1, wherein said
compression means performs JPEG compression, and
said control means sets the valid image area by
10 using a comment marker of a JPEG header.

5. An image communication apparatus for
communicating a color image with a distant apparatus
according to the ITU-T recommendations upon
15 establishing line connection, comprising:
original read means for generating image data by
reading an original image;
identification means for identifying a size of
the original image read by said original read means;
20 compression means for compressing the image data;
and
control means for, when the size of the original
image, identified by said identification means, is
smaller than a page size defined by the recommendation,
25 causing said original read means to read the original
image in the size of the original image, and performing

valid image data size identified by said size
identification means.

8. An image communication apparatus for
5 communicating a color image with a distant apparatus
according to the ITU-T recommendations upon
establishing line connection, comprising:

notification means for notifying the transmitting
side of information declaring that image data of a main
10 scanning size not more than a main scanning size
defined by the recommendation can be received; and

extraction means for extracting a valid area of
image data transmitted from the transmitting side in
response to the notification from said notification
15 means.

9. An image communication apparatus for
communicating a color image with a distant apparatus
according to the ITU-T recommendations upon
20 establishing line connection, comprising:

printing means for printing a color image on the
basis of an image signal;

determination means for determining a color
printing capability of said printing means; and

25 transmission means for transmitting information
about the color printing capability determined by said

determination means to a transmitting side using a control signal based on the recommendation.

10. The apparatus according to claim 9, wherein said
5 determination means determines the color printing capability in accordance with a type of color ink set and a type of printing medium in said printing means.

11. An image communication method for an image
10 communication apparatus for communicating a color image with a distant apparatus according to the ITU-T recommendations upon establishing line connection, comprising:

an identification step of identifying a size of
15 an original image;

a compression step of compressing the image data;
and

a control step of, when the size of the original
image, identified in said identification step, is
20 smaller than a page size defined by the recommendation, reading the original image upon adding invalid data thereto to make the original image have a size equal to the page size defined by the recommendation, generating image data and performing control to set a valid image
25 area of the image data compressed in accordance with the size of the original image in a case where the

image data is compressed in said compression step and transmitted.

12. The method according to claim 11, wherein the
5 invalid data is blank data.

13. The method according to claim 11, wherein the
invalid data is added when the original image is read
in a main scanning width of the page size defined by
10 the recommendation with a white plate placed behind the
original image in reading the original image.

14. The method according to claim 11, wherein said
compression step performs JPEG compression, and
15 in said control step, the valid image area is set
by using a comment marker of a JPEG header.

15. An image communication method for an image
communication apparatus for communicating a color image
20 with a distant apparatus according to the ITU-T
recommendations upon establishing line connection,
comprising:

an identification step of identifying a size of
an original image;
25 a compression step of compressing the image data;
and

a control step of, when the size of the original image, identified in said identification step, is smaller than a page size defined by the recommendation, reading the original image in the size of the original image, generating image data and performing control to designate a page size of the original image in a case where the image data is compressed in said compression step and transmitted.

10 16. An image communication method for an image
communication apparatus for communicating a color image
with a distant apparatus according to the ITU-T
recommendations upon establishing line connection,
comprising:

15 a size identification step of identifying a valid
image data size from a valid image area of compressed
data on the basis of a comment marker in a received
JPEG-compressed file; and

a selection step of selecting a printing medium
20 of a size suitable for printing on the basis of the
valid image data size identified in said size
identification step.

17. An image communication method for an image
25 communication apparatus for communicating a color image
with a distant apparatus according to the ITU-T

19. A computer-readable storage medium storing a program for executing an image communication method of communicating a color image with a distant apparatus
- 5 according to the ITU-T recommendations upon establishing line connection, comprising:
- an identification step module for identifying a size of an original image;
 - a compression step module for compressing the
- 10 image data; and
- a control step module for, when the size of the original image, identified by said identification step module, is smaller than a page size defined by the recommendation, reading the original image upon adding
- 15 invalid data thereto to make the original image have a size equal to the page size defined by the recommendation, generating image data and performing control to set a valid image area of the image data compressed in accordance with the size of the original
- 20 image in a case where the image data is compressed in said compression step module and transmitted.
20. A computer-readable storage medium storing a program for executing an image communication method of
- 25 an image communication apparatus for communicating a color image with a distant apparatus according to the

a selection step module for selecting a printing medium of a size suitable for printing on the basis of the valid image data size identified by said size identification step module.

5

22. A computer-readable storage medium storing a program for executing an image communication method of an image communication apparatus for communicating a color image with a distant apparatus according to the ITU-T recommendations upon establishing line connection, comprising:

a notification step module for notifying the transmitting side of information declaring that image data of a main scanning size not more than a main scanning size defined by the recommendation can be received, in response to an inquiry about a capability of receiving image data of an indefinite size from the transmitting side; and

an extraction step module for extracting a valid area of image data transmitted from the transmitting side, in response to a notification by said notification step module.

23. A computer-readable storage medium storing a program for executing an image communication method of an image communication apparatus for communicating a

color image with a distant apparatus according to the ITU-T recommendations upon establishing line connection, comprising:

- a printing step module for printing a color image
- 5 on the basis of an image signal;

- a determination step module for determining a color printing capability in said printing step module;
- and

- a transmission step module for transmitting
- 10 information about the color printing capability determined by said determination step module to a transmitting side using a control signal based on the recommendation.

ABSTRACT OF THE DISCLOSURE

In an image communication apparatus for communicating a color image with a distant apparatus according to the ITU-T recommendations upon line

- 5 connection, an original image is read by a scanner unit, and the size of the read original image is identified. If the identified size of the original image is smaller than the page size defined by the ITU-U recommendation, image data is generated by reading the original image
- 10 upon adding invalid data to the original image to make it have a main scanning length equal to the main scanning length of the minimum page size defined by the ITU-T recommendation in reading the original image through the scanner unit, and the image data is
- 15 compressed by a JPEG compressing unit and transmitted. In this case, the valid image area of the compressed data is set in accordance with the size of the original image. This allows the receiving side to read only the valid image area, decode the valid image area, and
- 20 reproduce the image.

FIG. 1

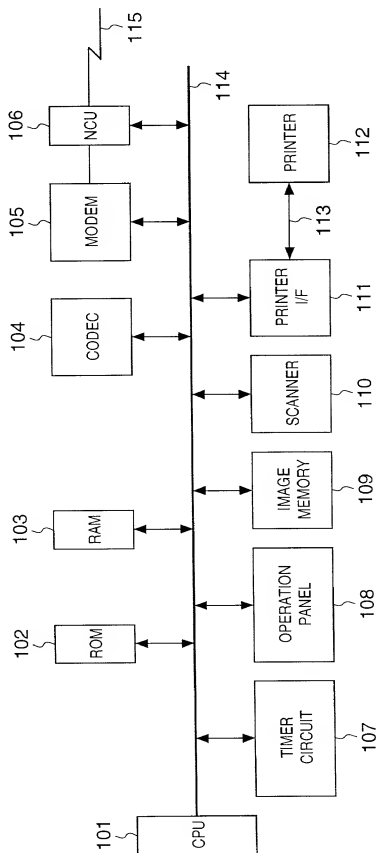


FIG. 2

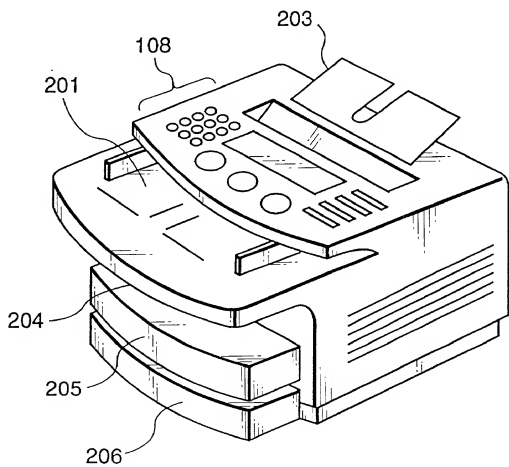


FIG. 3

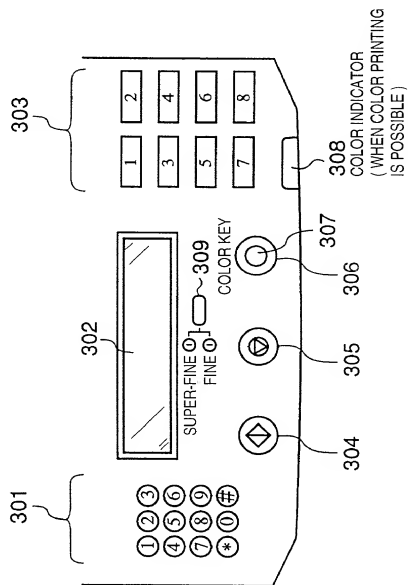
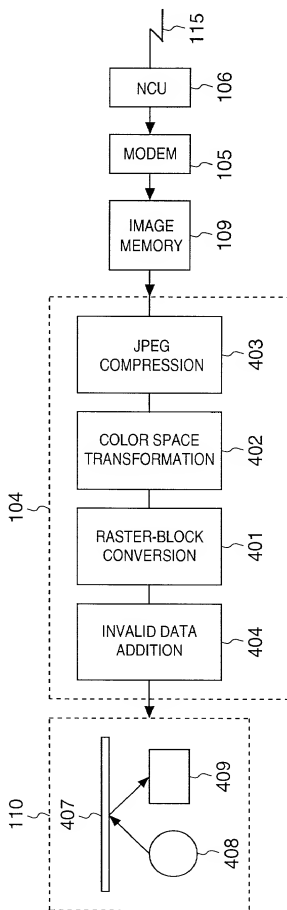


FIG. 4



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FIG. 5

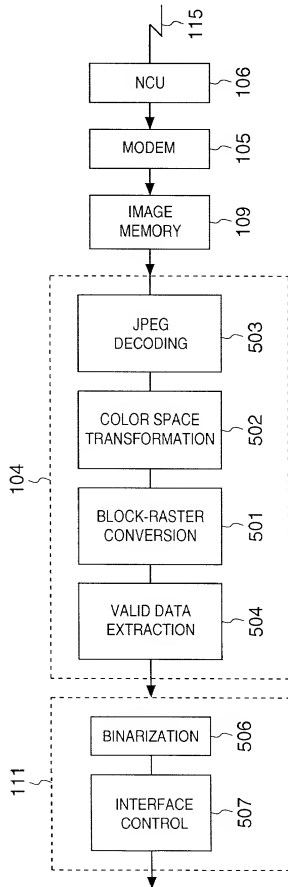


FIG. 6

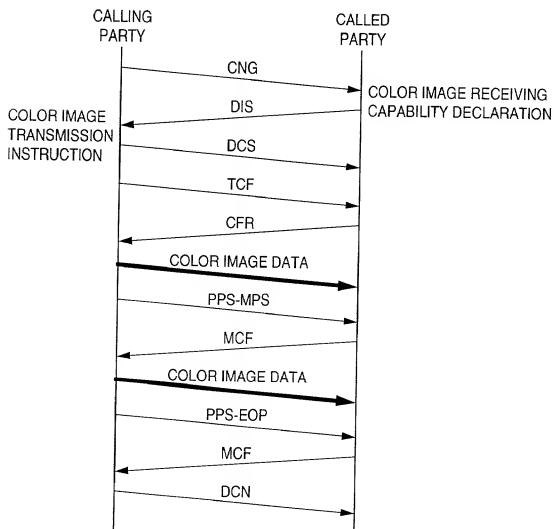


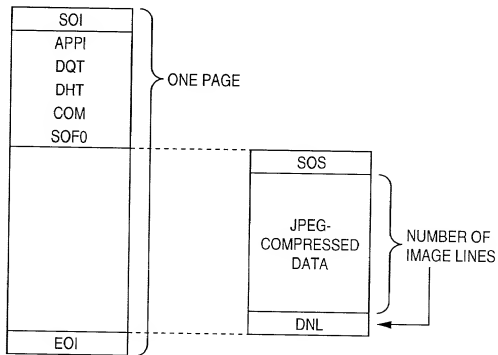
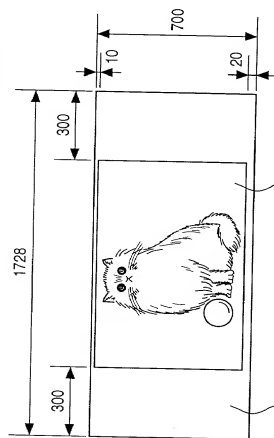
FIG. 7

FIG. 8

SOF0 : IMAGE DATA HORIZONTAL:1728 VERTICAL:700
COM : INVALID AREA LEFT=300, RIGHT=300, TOP=10, BOTTOM=20



AREA OF JPEG-
COMPRESSED IMAGE
DATA DESIGNATED BY SOF0

VALID IMAGE AREA FROM WHICH
INVALID IMAGE RANGES DESIGNATED
BY COM MARKERS ARE REMOVED

FIG. 9

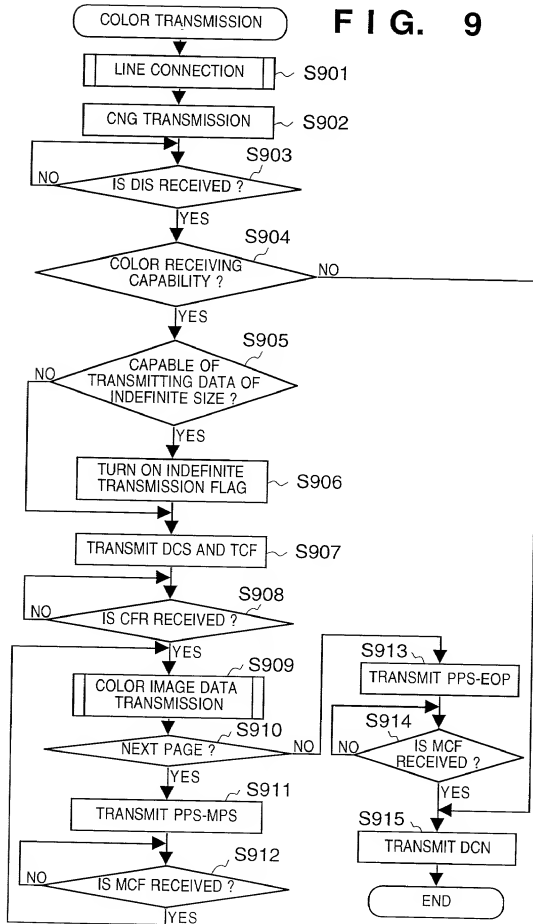


FIG. 10

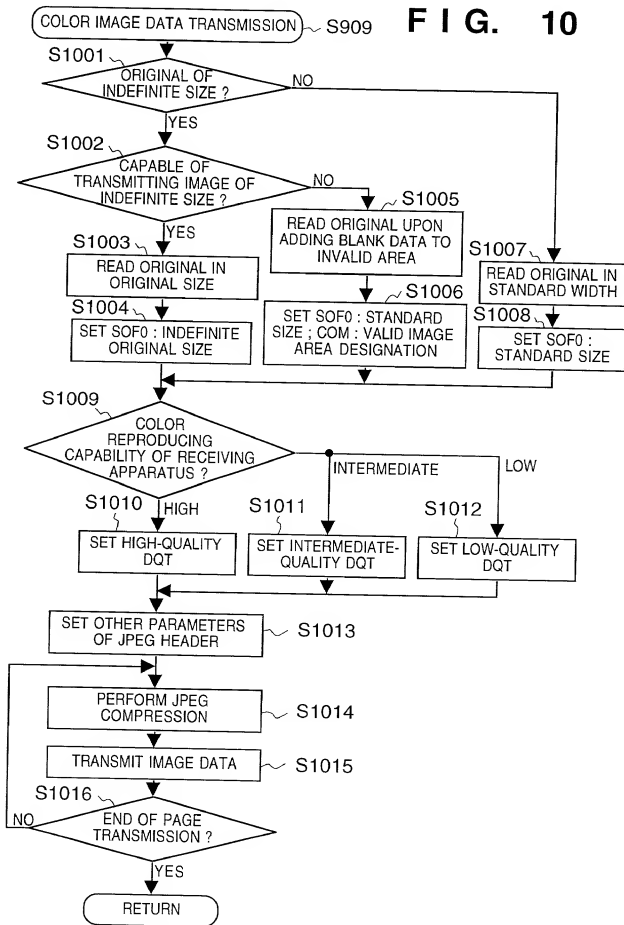


FIG. 11

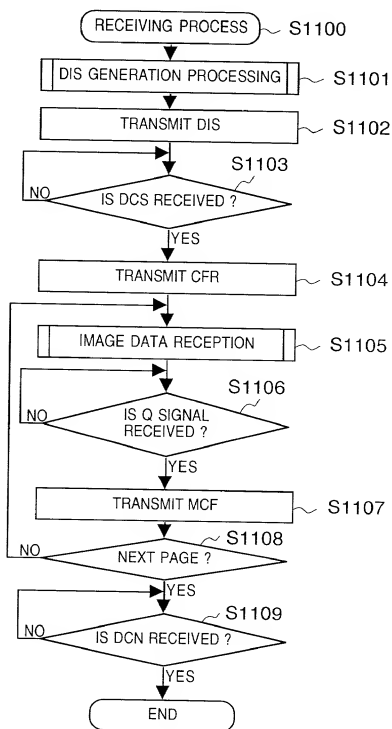


FIG. 12

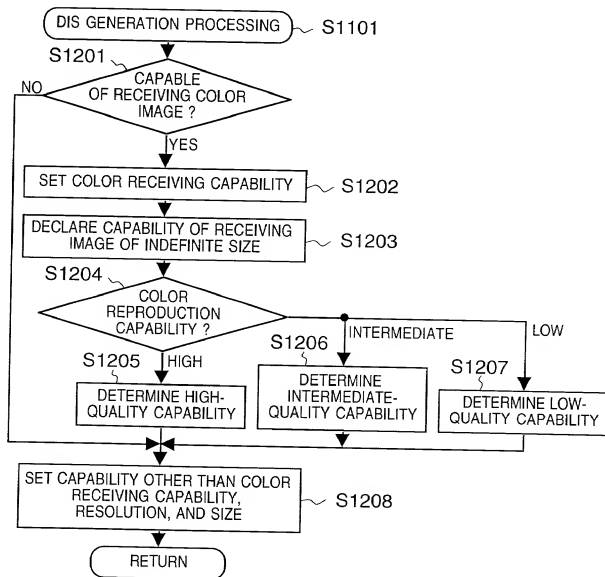


FIG. 13

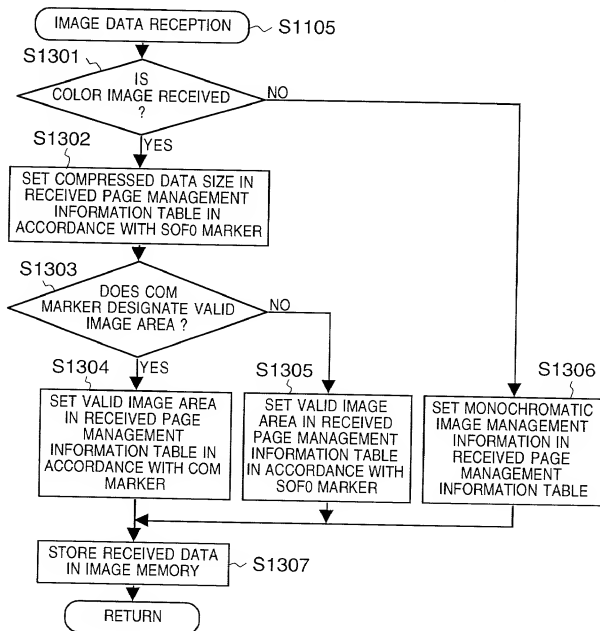
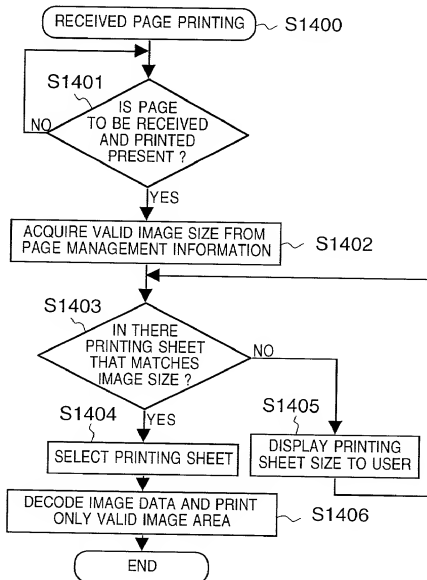


FIG. 14



006290-2/2550960

FIG. 15

PAGE MANAGEMENT
INFORMATION TABLE

NEXT_TABLE
DATA_TYPE
RESOLUTION
PAGE_H_SIZE
PAGE_V_SIZE
LEFT
TOP
VALID_H_SIZE
VALID_V_SIZE
MEMORY_BLOCK
DATA_SIZE

NEXT PAGE MANAGEMENT INFORMATION TABLE POINTER

PAGE DATA TYPE (JPEG/MH/MR/MMR)
 RESOLUTION (200/300/400dpi)
 PAGE DATA MAIN SCANNING PIXEL COUNT
 PAGE DATA SUB-SCANNING PIXEL COUNT
 VALID DATA START POSITION : LEFT END
 VALID DATA START POSITION : UPPER END
 VALID DATA MAIN SCANNING PIXEL COUNT
 VALID DATA SUB-SCANNING PIXEL COUNT
 IMAGE MEMORY BLOCK POINTER
 IMAGE DATA SIZE (BYTE COUNT)

COMBINED DECLARATION AND POWER OF ATTORNEY
FOR PATENT APPLICATION

(Page 1)

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name;

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

IMAGE COMMUNICATION METHOD AND APPARATUS

the specification of which [X] is attached hereto. [] was filed on _____

as United States Application No. or PCT International Application No. _____
and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR § 1.56.

I hereby claim foreign priority benefits under 35 U.S.C. § 119(a)-(d) or § 365(b), of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT international application which designates at least one country other than the United States, listed below and have also identified below any foreign application for patent or inventor's certificate, or PCT international application having a filing date before that of the application on which priority is claimed:

<u>Country</u>	<u>Application No.</u>	<u>Filed (Day/Mo./Yr.)</u>	<u>(Yes/No)</u> <u>Priority Claimed</u>
JAPAN	11-186727	30/06/1999	Yes

I hereby appoint the practitioners associated with the firm and customer number provided below to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith, and direct that all correspondence be addressed to the address associated with that Customer Number:

FITZPATRICK, CELLA, HARPER & SCINTO
Customer Number: 05514

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COMBINED DECLARATION AND POWER OF ATTORNEY
FOR PATENT APPLICATION
(Page 2)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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